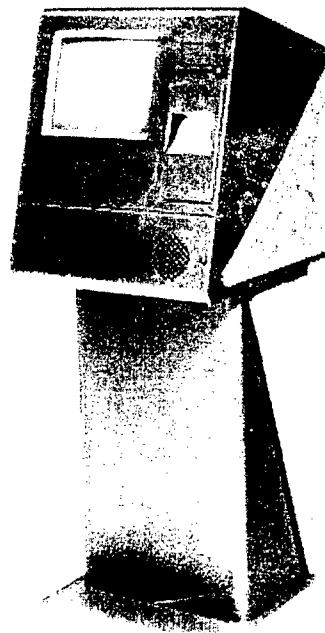




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Review and Assessment of Information Kiosk Systems

M E T R O • D A D E
T R A N S I T



Prepared for:
Metro Dade Transit Agency

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The Center for Urban Transportation Research (CUTR) has been approached by the Metro Dade Transit Agency to review the current state-of-the-art and assesses the progress that is being made in Kiosk Information Systems. This information will be used in developing a kiosk system for Metro Dade Transit Agency (MDTA), which has recently been awarded a Federal Transit Administration (FTA) Operational Test grant to develop an Informational Kiosk Prototype at major rail and bus transfer points.

This research was conducted by Eric T. Hill of the CUTR, under the sponsorship of the FTA Operational Test Program, and the guidance of Maria Elena Salazar, Manager, Information Services MDTA.

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Executive Summary

This report reviews the current state-of-the-art and assesses the progress that is being made, in Kiosk Information Systems. This information will be used in developing a kiosk system for the Metro Dade Transit Agency (MDTA), which has recently been awarded a Federal Transit Administration (FTA) Operational Test grant to develop an Informational Kiosk Prototype at major rail and bus transfer points.

A literature review of the Intelligent Transportation Systems (ITS) America National Clearinghouse and FTA's Advanced Public Transportation Systems project summaries revealed kiosk projects at several transit agencies. These transit agencies were surveyed to gather information about kiosk technology. This survey provided the following information about kiosk systems deployed or tested at transit agencies.

- The kiosk systems identified in this study were used primarily to provide travelers with transit information on fares, routes and schedules, presented in static and real time formats.
- Some kiosk systems offered users information on restaurants, tourist attractions, and the weather. Few kiosk systems gave travelers trip planning or itinerary features.
- None of the transit systems in the survey that have deployed kiosks allow users to make transactions (i.e., purchase tickets or passes).
- For most of the kiosk systems, an Automatic Vehicle Location (AVL) system was used to provide the kiosk real time information. Many of these systems also are linked to a Transit Operating System (TOS) or Customer Information System (CIS).
- Data for most of the kiosk systems was maintained at the site-location on CD-ROM or hard-drive and by telecommunication links with a server.
- Generally, the kiosk units include either a 486 or Pentium CPU, touchscreen monitor, and thermal printer.

- Except for a few of the kiosk units at MARTA, most of the units are placed inside a building such as a shopping mall or transit facility. Placing kiosks inside provides a cost-effective strategy for maintaining service quality against inclement weather, crime, and vandalism.
- Most of the transit systems that have deployed kiosks have transit or local police or other individuals at the host site, who in addition to other safety related duties, provide a measure of protection for the kiosk. For kiosks placed outside, the fact that it is located in a public place, with considerable activity, is a deterrent against any crime or vandalism.

A cost assessment of kiosk units was completed through interviews with kiosk vendors. The cost for kiosk units range from \$15K to \$20k per unit. The cost range for kiosk units reflect various factors. The lower end of the range may suggest an interior or semi-exposed kiosk; a kiosk in an exterior location will cost more because of the additional protection necessary from adverse weather conditions. Other factors may include economies of scale and customer specifications. Another factor that may influence the cost of developing a kiosk system is if there is a partnership with other public and private entities. Public/private partnership arrangements were developed for the Travelink project in Georgia and the Travlink project in Minnesota; kiosks were a component of both projects.

The survey of transit agencies asked whether there were any issues or obstacles during their kiosk projects. Generally, most of the issues or obstacles were caused by a breach in communication and coordination among participants in the project. For kiosk projects that provide only transit information, communication gaps between agency departments can jeopardize the success of the project. This issue becomes even more severe if the project involves coordination with outside agencies or private partners. Beyond having effective communication and coordination among participants, developing some criteria for site selection for kiosk units and making the system user-friendly were some "lessons learned" by transit agencies that have deployed kiosks.

Many kiosk projects use the cabinetry design, braille instructions, voice enunciation, and speakers to comply with the Americans with Disabilities Act (ADA). These techniques are consistent with the standards used to make ATM machines accessible to disabled users and with the ruling for technical specifications by the Justice Department. For users with

sight impairments, the research reveals a prototype talking kiosk. The talking kiosk uses a PC with a touchscreen and an accent speech synthesizer. It is called the "Talking Fingertip" technique and uses four types of auditory information combined with kinesthetic response.

Transit systems will have other issues to decide beyond the type of kiosk system to build, its cost and the information that will be offered through the kiosk. The literature suggests that the location of the kiosks, coordination with participants, marketing the devices to users, developing potential public/private partnerships, and changing technology are issues that may support or be obstacles to a successful kiosk system.

Before deciding on the information to provide through kiosks, it is recommended that MDTA survey current riders, non-users, and visitors to understand what features are most attractive in a kiosk system. In addition to the features revealed by the survey, it is recommended that the kiosk system generate a trip itinerary for users, provide real-time arrival and departure information on transit vehicles, and provide information on fares and routes. Beyond transit information, the kiosk should include information on traffic conditions, the weather, recreation, and tourist attractions.

This research showed that most of the kiosk systems do not include the ability to make any transactions such as purchasing tickets. Since this can cause significant security concerns, most agencies have decided to limit the services through the kiosk to providing only information. Until technology becomes available that will enable users to make financial transactions securely, it is recommended that MDTA omit this as a feature available at kiosks.

Before beginning the operational test, MDTA should investigate the possibility of soliciting kiosk vendors that are willing to provide in-kind technology to reduce the capital outlay and labor required for the kiosk system. Similarly, the opportunities for sharing cost and services should be discussed with other Metro-Dade County agencies that may be interested in providing information through a transit kiosk. This report also recommends that as part of the site selection criteria, MDTA should consider locations that are willing to share the cost for installation, maintenance, liability, and security of kiosks.

This research recommends that MDTA provide only information at the kiosk, thus, a

minimum security strategy is recommended. This may be achieved by placing the kiosks in highly visible sites, such as in a mall or transit center with access limited to normal business hours. MDTA should also consider protecting the integrity of the system by limiting public access through only kiosk units and other authorized links (i.e., Internet accounts). This report recommends that MDTA develop software in-house to restrict access from the public and the agencies linked to the system.

The system architecture design should include a server to provide connectivity to the kiosks and other databases (i.e., FDOT, Weather Channel, AVL, TOS, CIS) and a PC-based operator workstation to serve as the primary operator interface to the system. Besides allowing updates to the kiosks, the workstation should allow MDTA to track usage, conditions, and maintenance. To enhance system performance, the connection between the server and other databases should use a T1 line. This may also permit future expansions to the system without any significant changes to the system architecture. However, the cost of using a T1 line versus regular telecommunication connections will need to be evaluated. Therefore, deciding the fastest and most economic method of communications between the kiosks, server, and other databases may be more suitable for the selected vendor or MDTA.

The kiosk should contain an energy star-rated computer capable of supporting the minimum requirements for communications, data storage, input/output (I/O) rates and expendability. The computer should be, at a minimum, a 166 MHz Pentium processor with 4 gigabyte hard drive and 32 meg of RAM. A modem that operates at 28.8 bauds per second (Bps) or ISDN should be considered for linking kiosks to the workstation. Operating speed will depend on how much data is maintained at the kiosk site. The software should be written in a format to insure complete transferability of data to and from other databases. If possible, the software programming should enable the kiosk information to be displayed in HTML format. This will allow the same pages displayed on the kiosk to be used in an Internet website. A touchscreen, video display monitor, between 17" and 20" should be used and rated for outdoor use. The size of the monitor will depend on the site location. A thermal printer should be used since its paper delivery system is proven in kiosks and poses fewer problems with paper jams.

The cabinetry should be designed so that a laser printer can be placed in the kiosk to

provide maps or directions for the user. The printer should be environmentally protected, so that the printer paper does not become damaged by the rain, cold, or heat. It should appeal to a diverse audience of users (i.e., transit dependent, commuter, tourist, etc.) and potential host sites. The cabinetry should comply with ADA standards and include braille instructions, voice enunciation, and speakers.

This report recommends that MDTA consider designating an in-house staff person to serve as a System Administrator. This position should include the following responsibilities: serving as liaison with the public on issues involving kiosk operation; acting as point of contact for host sites; investigating and helping in resolving any problems with kiosk technology; coordinating meetings and communications with vendors and agencies that use the kiosk to distribute information; and upgrading and testing new software, hardware, and information for the kiosks. The qualifications for this position should include experience with MIS and transportation, and familiarity with ITS.

Besides using a touch screen interface for travelers to find information in the kiosks, the cabinetry design of the kiosk should include some user-friendliness features. The kiosk screen should use colors that limit eye strain but insure visual attractiveness to the passerby. Where possible, the screen should reduce the glare caused by the sun or external lighting. The dimensions of the screen should provide viewing for tall, short, and seated viewers. Kiosk information should be available in English and Spanish.

From a marketing perspective, a well designed interface screen can be an additional user-friendly feature. When a user ends their session and no queue is formed, an "inter-session" routine should take over. This subsystem can draw large colorful objects that constantly move across the screen or change the screen completely from one image to another. In addition, the screen can display a variable message sign to attract the attention of the passerby to abnormal conditions in the region such as traffic incidents.

Review and Assessment of Information Kiosk Systems

Introduction

This report reviews the current state-of-the-art and assesses the progress that is being made in Kiosk Information Systems. This information will be used in developing a kiosk system for MDTA.

MDTA has recently been awarded a Federal Transit Administration (FTA) Operational Test grant to develop an Informational Kiosk Prototype at major rail and bus transfer points. The prototype will consist of an interactive touch screen display with a real-time interface to the existing trip planning system. Passengers can enter origin and destination points, receive information on alternative routes and schedules, and determine the optimal schedules based on real-time information for bus arrivals and departures. In addition, the prototype will provide continuous information about the transit system and service messages such as emergency information, passes on sale, service changes, and special services.

Technical Approach/Methodology of Study

The study began by identifying kiosks projects with transit applications. A literature review was conducted using the Intelligent Transportation Systems (ITS) America National Clearinghouse and Federal Transit Administration, Advanced Public Transportation Systems project summaries. Kiosk projects, including those under development, existing and completed operational tests, and kiosk systems in full deployment, were identified from this review.

Next, a set of structured questions was developed to facilitate information gathering about kiosk technology. The transit agency or agencies responsible for the kiosk projects were contacted either by telephone and/or fax to collect the data and any other information pertinent to the study. Usually, the agency being contacted responded to the questions by telephone. After the data was collected, it was assimilated and analyzed to learn what stage of development each kiosk project was in, and to identify the progress of kiosk activities in transit. A copy of the questionnaire used to collect information on kiosk projects is included in an Appendix A. Appendix B provides a list of kiosk vendors

contacted in this study. Appendix C provides a summary of kiosk activities at the agencies that were surveyed.

This report is organized as follows. Section 1 gives a description of the MDTA Information Kiosk Operation Test. An overview of kiosk technology is presented in Section 2. In Section 3 applications of kiosk technology at transit systems in the United States are presented. Most of the information in this section is derived from the survey of transit systems using kiosks. The results of the survey are presented in the following subsections: Kiosk Functions, Security Techniques for Kiosks, state-of-the-art in Kiosks Technology, Kiosks User-Friendliness, and Other Considerations. Results and conclusions from this research are discussed in Section 4. Lastly, recommendations on kiosk hardware specifications for the MDTA Information Kiosk operation test are presented in Section 5.

1. MDTA Project Description

Currently, MDTA riders can find route and schedule information by either hard copies of transit schedules and route guides or calling a customer service representative. To give MDTA riders an automated trip planning capability, including on-line route and schedule information, the Agency is proposing to develop an Informational Kiosk Prototype.

The prototype will consist of an interactive touch screen display with a real-time interface to the existing trip planning system, Transit Operating System (TOS), and the Automated Vehicle Locator (AVL) system already in place at the agency. MDTA passengers can enter origin and destination points and receive information on alternative routes and schedules. Additionally, riders can determine the optimal schedules based upon real-time information on bus arrivals and departures.

A continuous display of updated information about MDTA will be provided through the kiosk system at major bus stops, bus transfer points, and rail and people-mover stations. The kiosk system will feature other service messages such as emergency information, passes on sale, service changes, and special services.

The core of the project consists of designing and developing the software required to link the various computer systems to accumulate data for real-time trip planning. Computer hardware will be purchased including central processing units, touch screens, and networking equipment for each location of the prototype. Construction of the prototype kiosk will include, cabinetry design, software development, installation of phone lines, and other equipment.

MDTA will undertake a post-implementation evaluation of the effectiveness of the proposed system based on customer satisfaction surveys, affect on ridership, cost of providing information, and increased revenues.

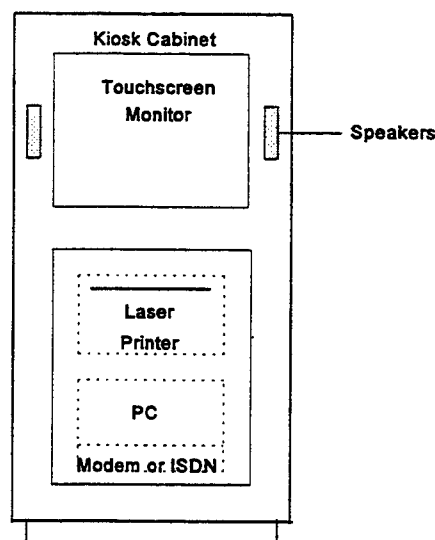
2. An Overview of Kiosk Technology

Communication and technology advancements provide unlimited opportunities for transportation agencies and systems to operate more efficiently and effectively. Intelligent Transportation Systems (ITS) use state-of-the-art technologies that allow vehicles, drivers, and roadways to communicate in a way that is safe, cost-effective, and provides many benefits to users. The transit component of ITS, Advanced Public Transportation Systems (APTS), yields similar advantages to transit agencies and riders. A component of APTS is *Traveler Information Systems*, which enable travelers to make informed travel decisions by providing accurate, up-to-the-minute information about traffic congestion, highway incidents, and transit service.

One of the best applications of traveler information systems being deployed and tested by transportation agencies are **Kiosks** - a network of small, light structures that impart information about transit routes and real time traffic reports, tourism, and other data. Kiosks are typically set up as a single central pillar. Travel information is usually presented on a video display. Some kiosks contain a printer that can produce selected hard copy, such as a trip plan. Information is entered through virtual push buttons, which are displayed visually on the screen (touchscreen). A virtual keypad and keyboard can be displayed for complex data entry. Information is displayed on the screen using a combination of text and still or animated pictures.

The major components of a kiosk system may include a server(s), operator workstation, telecommunications equipment, PC, touchscreen monitor, printer, speakers, and a modem or Integrated Services Digital Network (ISDN). An example of a kiosk unit is presented in Figure 1.

Figure 1
Example of a Kiosk Unit



As a traveler information system technology, kiosks may serve three functions: data gathering, data fusion and processing, and data dissemination.¹

For traveler information systems, data gathering describes the function of receiving information rather than raw data. Data fusion and processing consolidate data on a specific point or area in the transportation network from multiple sources. It provides additional value to the collected information through analysis, tailoring, and/or prediction. An example of this function is a personalized trip itinerary. Finally, data dissemination is the delivery of the processed information to the travelers.

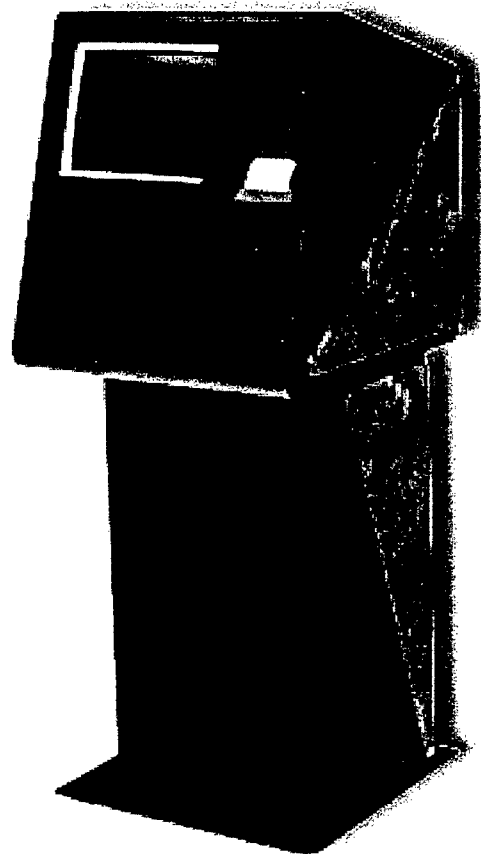
Kiosks use a personal computer-based system, which is connected via dedicated digital telephone lines to a telecommunications system. Using kiosks in a multimodal framework can provide information on both highway and transit travel. The highway aspect can convey real-time information about traffic conditions, incidents, construction, weather conditions, and park-and-ride lot space availability, and static information regarding routes, directions, and travel services. When applied specifically to transit, kiosks may provide personalized transit itineraries including routes, fares and ticketing, schedules, and origin-to-destination travel times. Kiosks are also useful in providing transit information to riders with visual and hearing impairments in a form that they can understand with a minimum of effort.

Informational kiosks combine the applications of other information systems into a single product. Figure 2 shows the other traveler information technologies and databases that can be integrated into kiosks and the information that may be available through kiosks. Separately, each of these technologies provides a useful tool to improve mobility for travelers, but informational kiosks provide an effective link between the array of information systems and travelers.

¹J. Richard Nelson, Tom Tran, *"Public/Private Partnerships in Traveler Information Services,"* paper presented at 1996 Annual ITS Meeting, Houston, April 1996.

Figure 2
Integration of Traveler Information Technologies

- **Traveler Information Technologies**
 - Automatic Vehicle Location (AVL)
 - Transit Operating System (TOS)
 - Customer Information Systems (CIS)
 - Regional Transportation Database
- **Information from kiosk**
 - Real-time arrival/departure
 - Real-time schedules
 - Static arrival/departure
 - Static schedules
 - Routes
 - Fares
 - Paratransit services
 - Car/vanpool services
 - Regional transit services
 - Traffic conditions
 - Restaurants/Entertainment
 - Tourism/Attractions
 - Recreation
 - Weather Channel
 - Trip planning/ itinerary
 - Major destinations



3. Applications of Kiosks Technology

A list of transit agencies with kiosks in operation was developed from the available literature and from contacts at the FTA and ITS America. This list of kiosk projects include multimodal systems (i.e., provide information on both highway and transit travel) or transit specific kiosks. These projects are presented in Table 1 and described in this section.

Table 1
List of Kiosk Projects

Project Description	Responsible Agency	Contact Person
Information Kiosk	Ann Arbor Transportation Authority, Ann Arbor MI	Greg Cook (313) 677-3902
Travelink	Metropolitan Atlanta Rapid Transit Authority, Atlanta GA/ Georgia Department of Transportation	Todd Long (404) 651-8475
Traveler Assistance Network	Baltimore Mass Transit Administration, Baltimore, MD	David Hill (410) 333-3437
Information Kiosks	Regional Transportation District, Denver, CO	Lou Ha (303) 299-6265
Houston Smart Commuter	Metropolitan Transit Authority of Harris County (Houston Metro), Houston, TX	S. Venkat Raman (713) 881-3030
Los Angeles Smart Traveler	California Department of Transportation, Public Transit Branch Los Angeles, CA	Cliff Loveland (916) 654-9970
Travlink Project	Minnesota Department of Transportation, Minneapolis/St. Paul, MN	Marilyn Remer (612) 582-1601
Multimedia Kiosks	New Jersey Transit, Newark, NJ	Lou Wassong (201) 378-6906
Smart Interactive Kiosks	Metropolitan Transportation Authority - New York City Transit, New York, NY	Angelita Hutchinson (718) 694-3232
Information Kiosks	Seattle Metro, Seattle, WA	Catherine Bradshaw (206) 684-1770
National Capital Region Traveler Information Showcase	Washington Area Metro Agency, Washington, D.C., et al.	Karen Lamb (202) 962-2790

The agencies listed above were surveyed to learn the following aspects of kiosk technology:

- type of transit information available to transit customers;
- cost of technology and opportunities for cost sharing with other entities;
- security techniques used by transit agencies for kiosks;
- type of technology used (e.g. hardware and software); and
- other user friendliness features.

The person listed as the contact provided information to the survey either by telephone and/or fax. For some kiosk projects, information from the survey is supplemented with information from the literature review.

Out of the 11 agencies surveyed about kiosks, two of the agencies (RTD and WMATA) provided limited information about their kiosk systems because the projects were ended or in a preplanning stage.

RTD in Denver currently has an AVL system, which provides real-time information to dispatch. The agency was planning to use the AVL system to interface with kiosk-type displays at the new Denver airport and at park-and-ride lots. This project was ended because of a lack of funding. This project included some cost sharing with the prime contractor, Westinghouse Transportation Systems. RTD is considering another operational test of kiosks in the future, but unsure of the timeframe for this project.

The Washington Area Metro Authority (WMATA) and 26 other Washington, D.C. area transit providers are developing the "National Capital Region Traveler Information Showcase." While WMATA is the lead agency, the project is being funded by the Virginia Department of Transportation. This project is in the pre-planning stage and will include computerized kiosks with real-time information on transit vehicle arrivals and departures, traffic tie-ups and other commuter information. Information will be transmitted to the kiosks from a central traffic control center, which will receive updates from satellites, road bed sensors and video cameras. WMATA reports that a demonstration test of this technology will be conducted in 1997. A contract has been awarded to Battelle, an engineering firm, to develop the technology and kiosk system. WMATA is also planning to market the kiosk system to developers and building owners.

3.1 Kiosk Functions

- Ann Arbor Transportation Authority (AATA)

AATA is developing a traditional kiosk facility that will be implemented within the next one to two years. The kiosk facility will include LED signboards (rather than interactive devices as shown on page 11) at two transit hubs and give travelers real-time information on schedules. Transit information, routes, and next-stop announcements also will be provided at kiosks. Additional information will be provided on restaurants/entertainment, tourism/attractions, and recreation in the area. The system cannot make any transactions. Card and ticket purchases will be made from a ticket agent or vending machine. Information at the kiosks will be offered in English. The marketing department at AATA is researching the possibility of offering information in French and other languages.

- Metropolitan Atlanta Rapid Transit Authority, Atlanta GA

Travelink, a link between the high technology world of traffic engineering and the public, was showcased during the 1996 Olympic Games in Atlanta. This project included 130 public access kiosks for distributing advanced traveler information to improve the mobility of travelers in the state of Georgia and the metropolitan Atlanta region. Kiosk information was provided by MARTA. Information provided through the (touch-screen) kiosks includes static arrival and departure information, static schedules, routes, fares, information on car/vanpool services, traffic congestion, restaurants/entertainment, tourism, recreation, and weather. Additionally, the system provides itinerary planning. Information from the kiosk is provided in English only. Because of successful testing during the Olympics, MARTA is planning to expand the system within the next year.

- Baltimore Mass Transit Administration (MTA), Baltimore, MD

MTA has tested one kiosk with a touch-screen, which contained static data from published timetables. The agency is planning to upgrade the kiosk hardware and software and install more kiosks around the city of Baltimore. It is expected that this process will be completed within a year. As a result, the updated system will include real-time information on schedules, routes, fares, and information on regional transit services, e.g., commuter or light rail service. Information also will be provided on tourism and recreation in the service area. The kiosk will also print trip itineraries. Information will be provided in English only.

- Metropolitan Transit Authority of Harris County (Houston Metro), Houston, TX

Houston Metro is developing a kiosk system and expects to test the system within the next six months. The system will give travelers static schedules for transit routes, fares, and information about traffic congestion in the service area. Information will be provided to travelers in English and Spanish.

- California Department of Transportation, Public Transit Branch Los Angeles, CA

The California Department of Transportation (Caltrans) completed a demonstration of interactive (touch-screen) kiosks for travelers as part of the Smart Traveler program², which is a free automated information service for commuters. Seventy-eight kiosks were fully installed and operational throughout the LACMTA service area. Operational test funding for the project ended in June 1995. However, Caltrans reported that a few of the kiosks are still being used as demonstration units and several are in Santa Barbara to be used for future prototype development, which will take place in the next two years.

An interactive touch screen allows a traveler to find the following information: real-time freeway conditions throughout the Los Angeles area; LACMTA bus, train, and shuttle schedules, routes and fares; transit itineraries, which can be printed at the kiosk; and the current list of carpoolers registered in the area. The kiosks do not allow travelers to make transactions. Information is provided in English and Spanish.

- Minnesota Department of Transportation (Mn/DOT), Minneapolis/St. Paul, MN

Travlink, a Minnesota Guidestar³ operational test, represents the integration of a computer-aided dispatch (CAD) and AVL system based on GPS, advanced traveler information systems (ATIS), and an automatic vehicle identification (AVI) system in the I-394 corridor

²Smart Traveler is a public/private partnership directed by Caltrans in conjunction with the LACMTA, Commuter Transportation Services, Inc., Federal Highway Administration, Federal Transit Administration, Health and Welfare Data Center, IBM, North Communications, Pacific Bell, and Pacific Bell Information Services.

³Minnesota Guidestar is Minnesota DOT's (Mn/DOT's) program for ITS, and is actively testing and deploying new technologies that improve the movement of people, goods, and services.

in the Minneapolis/St. Paul metropolitan area.⁴ As part of Travlink, an operational test of kiosks was conducted from December 1994 to December 1995. The test included three interactive kiosks in downtown locations: two at business centers and one at a transit store. The kiosks provide information on the following topics: real-time arrival/departure information, static schedules, routes, fares, information on paratransit services, and carpool and vanpool services. Information on traffic congestion, construction, and maintenance was also provided through the Travlink kiosks. The kiosk provided trip itineraries for users but do not allow users to make transactions. Information was provided in English only.

- New Jersey Transit, Newark, NJ

New Jersey Transit (NJT) originally planned to begin testing of "smart" kiosks in 1995, which would be followed by system wide deployment. However, the kiosk equipment for this project was rebid because the selected vendor, which agreed to supply the equipment at no charge, defaulted on the project. NJT is planning to have a demonstration test of this technology completed within the next two years. As envisioned by NJT, these devices will give passengers real-time arrival and departure information, real-time schedules, static information on transit, routes, fares, and recommended alternate routings in case of delays. They will provide trip planning services for passengers and can respond to passenger inquiries. The kiosks will show locations of bus stops and transfer points, local points of interest, restaurants and shopping centers, and maps of the service area. Transactions are not available at the kiosks. A future enhancement will include information in Spanish.

- Metropolitan Transportation Authority - New York City Transit, New York, NY (MTA)

MTA is in the process of planning and defining a kiosk system. Smart interactive kiosks will be placed at major transit stops/tourist sites. The agency predicts that it will take one year to install the system. When deployed, the kiosks will give travelers real-time and static information on schedules and transit information, routes, fares, information on regional transit services, including commuter or light rail, and promotional information. The

⁴Carol L. Schweiger, *Review and Assessment of En-Route Transit Information Systems*, report prepared for US Department of Transportation, Volpe National Transportation Systems Center, July 1995, 29.

kiosks will show bus stop locations, transfer points, track diversions, total trip time, and service disruptions. Information on restaurants, tourism, and recreation will also be available. Additional kiosks features will be limited to trip planning and itinerary and a value-added feature for the MetroCard system. The system will provide information in English only.

- Seattle Metro, Seattle, WS

Seattle Metro is providing commuters in the Seattle and Puget Sound area with two types of kiosk applications.

Riderlink is an on-line service that can be reached via the Internet through the Worldwide Web (WWW). Seattle Metro is partnering with the Overlake Transportation Management Association (TMA) to provide commuters with information about alternatives to driving alone. Riderlink can be used on a network or in a stand-alone mode, i.e., kiosks. Four kiosks were installed in May 1995 at selected Overlake TMA employer sites. Information available on the web-page and through the kiosks is presented below.

- Bus routes, schedules and fares for Metro services.
- How to form a vanpool, driver qualifications, vanpool fees.
- On-line ridematch application.
- On-line forms to submit customer feedback to Metro.
- Bicycling information (including Metro's Bike & Ride programs).
- Information about the Commute Trip Reduction Law.
- Ferry routes and schedules.
- Freeway congestion information from Washington Department of Transportation (WDOT).
- Road construction updates from WDOT.

Besides Riderlink, Seattle Metro is planning to test a kiosk system for regular travelers within the next year. The system will give travelers static arrival/departure information static schedules, routes, fares, information on paratransit, car/vanpool services, and service to major destinations. Additionally, the system will provide traffic congestion, ferry schedules, road construction updates, and biking information. Other services at kiosks will be limited to trip planning and ridematching capabilities. A special feature of the system will give users limited access to their E-mail. Information on the kiosks will be provided in English only.

3.2 Security Techniques for Kiosks

Protecting kiosks from crime and the elements is another area reviewed as part of this research. The survey of transit agencies included questions about the security techniques used by transit agencies for kiosks (i.e., protection against vandalism and theft). Agencies were also questioned about the techniques used to maintain system reliability during inclement weather and system failure.

The survey revealed three components to securing kiosks: location, cabinetry design, and access.

Several transit agencies said their kiosks were indoors: a mall, shopping area, or transit facility, such as a terminal. For those agencies that deploy kiosks in malls or other public areas, the host site agrees to provide security by either remote cameras or security guards. As a courtesy, employees at the host site monitor the kiosks to ensure protection against crime. One transit agency, AATA, plans to contract with the local police to provide minimum security for their kiosks as well as other aspects of their system. For transit agencies with kiosks placed inside their own facilities (i.e., terminal), these agencies said they used transit police to protect the kiosks as part of their overall responsibility. Additionally, since the machines do not have ticket or card dispensing capabilities, they are usually placed near a ticket vendor (i.e., a transit employee), who also provides additional security. For agencies with kiosks in outdoor locations, usually transit police or contracted security is used. In these instances, the kiosks are placed in areas with high visibility, which helps to serve as a deterrent against any crime.

Features in the kiosk hardware also provide security against crime and protection from the weather. Generally, the cabinetry design provides protection from most vandalism or break-ins. In the Travlink project, the Minnesota Department of Transportation (Mn/DOT) said that, except for the keyboard, the CPU, modem, and printer are all locked inside the cabinet. Additionally, the cabinet is secured to the floor or wall, depending on the location. The cabinetry also can provide protection against the elements. MTA in New York is planning a kiosk system with a cabinetry design that is resistant to the inclement weather. The kiosk units used by MARTA have air conditioning and heating installed in the cabinetry. These features keep the units from overheating and dry if moisture is present. As part of the procurement contract, the vendor for the Houston Metro kiosk project is required to use units that have proven resistance to the weather.

Lastly, limiting access to kiosk units also may serve as a deterrent to crime. Many agencies in the survey that tested kiosks in public places, such as malls, could restrict travelers to using the system during mall hours only. Similarly, for kiosks placed at transit facilities, access was limited to the service hours of operation.

3.3 State-of-the-art in Kiosks Technology

The survey of transit systems using kiosk technology included questions about the hardware, software, and communication technology used for the system. In addition, this effort attempted to reveal any maintenance required for this technology, possible equipment integration with other ITS technology, prominent vendors, and lessons learned. Responses from the survey that provide information about the state-of-the-art in kiosks technology are presented in this section.

Information on the technology that the agencies in the survey used, or are planning to use, for their kiosk projects is presented in Table 2. The vendors for each of the kiosk projects are also presented. Major system components include a server, telecommunications equipment, kiosk computer hardware, kiosk cabinet enclosures, network cards, and printers. Additionally, the type of interface (i.e., human or electronic) between the kiosk system and other ITS is noted. Information for three of the transit systems in the survey has been omitted. NJT and WMATA are not represented because these kiosk projects are in the planning and definition phase. The RTD kiosk project was ended because of a lack of funding.

Table 3 provides an approximate cost for each of these kiosk projects. Some cost estimates are for designing and building the kiosk units and do not include cost for installation, internal labor, maintenance, software development, electrical service, and telecommunication equipment (i.e., telephone lines, a computer network, etc.).

The cost range for kiosk units reflect various factors. The lower end of the range may indicate an interior or semi-exposed kiosk; a kiosk in an exterior location will cost more because of the additional protection necessary from adverse weather conditions and security. Other factors may include economies of scale and customer specifications.

Table 2
Kiosk Hardware Specifications

Agency	Type of hardware	Customer Interface	Integration with other ITS	Type of AVL ¹	Data maintenance	System maintenance/monitoring	Vendor
Ann Arbor, MI AATA	LED signboard	N/A	AVL, TOS, CIS ²	GPS ³	Fiber-optic cable	Contract with police, ticket agents, and surveillance camera	Rockwell International
Atlanta, GA MARTA	133 MHz Pentium CPU, 2 gigabyte hard drive, and 32 meg of RAM	20" touch screen, thermal printer	Electronic interface with TOS, and CIS	N/A	At-site and central location via a modem (56 bps), fiber-optic cables, and hard drive	Kiosk Control System software and service technician	JHK & Associates
Baltimore, MD MTA	Pentium CPU	17" touch screen, specialized printer	Electronic interface with AVL, TOS, and CIS	GPS	At-site and central location via modem, fiber-optic cables, and hard drive	Kiosk is monitored electronically	Transportation Management Solutions
Houston, TX Houston Metro	To be determined by the City of Houston	Touch screen	CIS	N/A	At-site and central location via modem and fiber-optic cables	Will be maintained by IBM under contract with City of Houston	Northern Communications

¹ Automatic Vehicle Location (AVL)

² Transit Operating System (TOS), Customer Information System (CIS)

³ Global Positioning System (GPS)

**Table 2 (continued)
Kiosk Hardware Specifications**

Agency	Type of hardware	Customer interface	Integration with other ITS	Type of AVL ¹	Data maintenance	System maintenance/monitoring	Vendor
Los Angeles, CA CALTRANS	486 CPU	19" touch screen, keyboard on screen, dot matrix strip printer	Electronic interface with CIS	In ground loop devices	At-site and central location via a modem (28.8 bps)	Motorola and IBM monitored remotely; a host site agreed to monitor	Motorola, IBM, and Northern Communications
Minneapolis, MN Travlink	Zeos 486DX CPU	17" SVGA touch screen, small format printer	Electronic interface with AVL and CIS	GPS	At-site and central location via a modem (14.4 bps)	ATIS server system; checked twice a week by system admin.	Transportation Management Solutions, Inc.
New York, NY MTA/NYCT	Pentium 90 MHz CPU	17" touch screen	Electronic interface with AVL and CIS	GPS, Dead reckoning	At-site and central location via a modem (28.8 bps) and CD-ROM	Self diagnostic routine to test memory and functionality.	Transportation Management Solutions, Inc.
Seattle, WS Seattle Metro	486 CPU	Touch screen, a standard keyboard, laser printer	Electronic interface with timetable production system	N/A	Central location via a modem (ISDN) ⁴	Internal staff check kiosk	Lexitech

¹ Automatic Vehicle Location (AVL)

² Transit Operating System (TOS), Customer Information System (CIS)

³ Global Positioning System (GPS)

⁴ Integrated Service Digital Network (ISDN)

Table 3
Approximate Cost for Kiosk

Responsible Agency	Project Description	Approximate Cost
Ann Arbor Transportation Authority	Information Kiosk	N/A
Metropolitan Atlanta Rapid Transit Authority/ Georgia Department of Transportation	Travelink	\$15k - \$20k per unit capital expense \$50k - \$100k telephone link \$850 per unit monthly telephone service fee \$256 per unit
Baltimore Mass Transit Administration	Traveler Assistance Network	Estimate for entire system: \$3.2 mil.
Metropolitan Transit Authority of Harris County (Houston Metro)	Houston Smart Commuter	\$10k - \$12k per unit
California Department of Transportation, Public Transit Branch Los Angeles, CA	Los Angeles Smart Traveler	\$18k - 26k per unit \$336 - \$399 monthly equip. \$2k for other monthly exp.
Minnesota Department of Transportation, Minneapolis/St. Paul	Travlink Project	N/A
New Jersey Transit	Multimedia Kiosks	Estimate for entire system: \$300k
Metropolitan Transportation Authority - New York City Transit	Smart Interactive Kiosks	\$15k per unit \$174K for software development
Seattle Metro	Information Kiosks	\$18k per unit
Washington Area Metro Agency, et al.	National Capital Region Traveler Information Showcase	N/A

Besides the questions about the technologies employed by transit agencies using kiosks, the survey revealed information about technical and institutional issues involved with deploying information kiosks. The agencies also were asked if there were "lessons learned" that would benefit other organizations developing and implementing information kiosks. Selected responses to these questions are presented below. Some transit systems responded with documented reports to supplement their written answers. Two agencies also provided results from surveys of kiosk users.

3.4 Technical/Institutional Issues

- Metropolitan Atlanta Rapid Transit Authority, Atlanta GA

Deciding what information to provide and coordination between agencies is important, because it will involve communications between computer systems.

- Metropolitan Transit Authority of Harris County (Houston Metro), Houston, TX

Main issues were communication and cost. A frame relay network is being used instead of dedicated lines.

- California Department of Transportation, Public Transit Branch Los Angeles, CA

Highway, transit, and ridershare information came from different databases and had to be converted to kiosks. Logistics of assembling information from several entities, i.e., a welfare agency, Pacific Bell, etc. was difficult to complete in a short timeframe. Since many kiosks were placed at a host site, the parties involved needed to agree on issues of potential liability.

- Minnesota Department of Transportation (Mn/DOT), Minneapolis/St. Paul, MN

This project involved a public-private partnership. The two largest problems identified by the participants were the length of time the project took and the legal issues that contributed to the delay. The major obstacles to carrying out the agreements were legal issues. The key issues of concern for both sides included proprietary issues and property rights; copyright and ownership; license agreements; confidentiality; and ability to carry out partnership agreements under Minnesota enabling legislation. The key non-legal stumbling blocks identified by the participants included the turnover of key staff midway through the project; internal staff resources and competition; obtaining senior level buy-in; and the fact that there was not one single project manager.⁵

⁵Cambridge Systematics, Inc., *Travlink Operational Test Institutional Analysis*, July 1995, 4-2.

- New Jersey Transit, Newark, NJ

The major technical issue is developing a readable and accurate map of the service area.

- Seattle Metro, Seattle, WS

This project suffered from three problems: continued printer jams (laser printer); host-site representatives were frequently required to reboot the kiosk; and the kiosks were difficult to use for people who do not generally use computers.

Each kiosk has Internet access and runs Netscape. The first challenge was to limit kiosk users' access to the Internet. Employers did not want employees "surfing the net" in the lobby. Software was developed in-house that restricted the services that could be accessed from the kiosk. The first attempt at this was inadequate because "hackers" at one site could break through. Access was restricted to a limited set of servers only after the public network at Metro was reconfigured so kiosk connections went through the firewall router and not directly to the Internet service provider router.⁶

The in-house software was designed to return the kiosk to the Home Page after five minutes. This helped to avoid the problem of kiosk users walking up to the kiosk and seeing the last page viewed by the previous user. The kiosk PCs also needed to be specially configured to protect locally stored files and prevent users from breaking out of the Netscape application.⁷

Metro selected Integrated Service Digital Network (ISDN) service to connect the kiosks to Metro's Wide Area Network to provide a high speed communication link.⁸

⁶Metro Transit, King County Department of Transportation, *Riderlink Demonstration Project Evaluation Report*, February 1996, 36.

⁷Ibid

⁸Ibid.

3.5 Lessons Learned

- Metropolitan Atlanta Rapid Transit Authority, Atlanta GA

An important "lesson learned" from this project was that some criteria for site selection of kiosks should be established that is based on traffic and potential users, i.e., transit riders and visitors. Site selection should also consider potential sun-glare on the screen.

- Baltimore Mass Transit Administration (MTA), Baltimore, MD

All participants in the project should be involved early and throughout the project.

- Metropolitan Transit Authority of Harris County (Houston Metro), Houston, TX

Working with potential host sites for a kiosk is difficult. Standard agreements on installation, liability, maintenance, etc. should be in place before approaching building and property owners.

- California Department of Transportation, Public Transit Branch Los Angeles, CA

Conduct a survey of types of information that travelers will find useful. Site selection should be based on potential use. Make the kiosk as user-friendly as possible. A significant share of travelers could not spell or use a computer. Most users want to know their travel options, using travel time and cost of a trip as criteria.

- Minnesota Department of Transportation (Mn/DOT), Minneapolis/St. Paul, MN

In addition to the other menu choices, transit trip planning should be included as a capability of the kiosks. This will allow users to identify their current location and their desired location and then the software would tell them what bus(es) to take to make the trip. The kiosk screen should include maps and other useful graphics.⁹

⁹Cambridge Systmatics, Inc., *Travlink Operational Test Evaluation Report*, August 1995, 8-10.

The evaluation of the Travlink project included a survey of the kiosk users.¹⁰ The survey revealed that the kiosks were used most frequently between the hours of 11:00 a.m. and 6:00 p.m. Seventy percent of respondents that accessed travel information at the kiosks were men. Fifty-eight percent of the respondents were in the 21 to 40 age category. Seventy percent said they were seeking bus schedule or route information. Sixty percent were satisfied or very satisfied with the information in the kiosks. Sixty-five percent said they found the kiosks easy to use.

- New Jersey Transit, Newark, NJ

Use a vendor with verifiable experience in transit and knowledge of telecommunications.

- Seattle Metro, Seattle, WS

Response time is important; kiosk users will not tolerate a slow response while a file is downloaded. Ongoing maintenance of the kiosk system requires a telecommunications support person. Part of this person's responsibilities would be to investigate and resolve any problems with the phone connections and Digiboard equipment (Datafires and Dual IMACs) that support ISDN service to the kiosks. Additionally, expansion of the kiosk system will determine the kinds of skills needed to do that work. For example, additional kiosks would increase the need for telecommunications support; the preparation of new and unrelated materials would increase the need for customer information staff and programmers; upgrading and testing new server software would require more time from programmers; upgrading the server itself or moving to a different server would require a system administrator.¹¹

Surveys of kiosk users were conducted at two different kiosk locations.^{12 13} Many respondents (41.8%) said the kiosk was easy to use. An overwhelming share,

¹⁰Ibid, 4-33.

¹¹Metro Transit, King County Department of Transportation, *Riderlink Demonstration Project Evaluation Report*, February 1996, 39.

¹²Ibid, C-1.

¹³Data was recalculated to show aggregate results.

approximately 95 percent, of respondents said the information from the kiosk was valuable. Seventy-six percent of respondents said they would use Riderlink if they had a way to find it. Approximately 51 percent of the respondents were women. Most respondents were in the 45 to 54 age category.

3.6 Kiosks User-Friendliness

No matter how great the potential benefits of a kiosk might be, the ultimate benefits are determined by how much they are used. Getting travelers to use the kiosk will depend on the user-friendly features that are built into the system. A review of the literature revealed two important features on kiosk user-friendliness: user interface and accessibility for the disabled traveler.

3.6.1 User Interface

An intuitive user interface is vital to the success of kiosk projects. Nearly all travelers will be using the kiosk without the benefit of training. Transit dependent riders often do not have any prior computer experience and few assumptions can be made about their computer skills. The survey of transit agencies revealed that many kiosk projects use touch screens to find information in the kiosk. Touch screens have become a popular alternative to keypads and trackballs as an input device for kiosks. Two important skills that merit consideration by the designers of these technologies are the manipulation of the input device and recognition of screen "hot" areas. Users that have limited exposure to this type of computer technology may become discouraged and refrain from using a kiosk.

Another issue that will be faced in designing a user-friendly touch-screen is deciding whether to add more screens to the system or putting many choices on one screen. Using multiple screens may satisfy user needs quickly. This may prevent the user from being forced to study a particular screen for some time. Additionally, a user interface may be further simplified by requiring the user to make only one choice on each screen. The challenge to providing this user-friendly feature is that it leads to complex screens and a more difficult system architecture. It also creates several screens and requires software code and on-line storage to handle them.¹⁴

¹⁴J.L. Schroeder and Jeff Green, *The Emergence of Smart Traveler Kiosks and the User Interface Requirements for their Successful Deployment*, proceeding from 1995 Annual ITS Meeting in Washington, D.C., 834.

In addition to the touch screen interface, signs and cabinet design can enhance the user-friendliness of kiosks and help to stimulate user interest, but in many environments these are inappropriate, strictly regulated, or prohibited.¹⁵ For example, the design or color of the kiosk unit may be unacceptable for a hotel lobby.

3.6.2 Accessibility for the Disabled Traveler

The transit agencies that responded to the kiosk survey were asked about the techniques used to comply with the Americans with Disabilities Act (ADA). Some agencies said that the cabinetry design of the kiosk, braille instructions, voice enunciation, and speakers were the only technique used to comply with the ADA. A few of these agencies referred to standards used for ATM machines to make kiosks accessible to disabled users (i.e., visually and hearing impaired users and persons using wheelchairs). Additionally, the Justice Department has ruled that if you do not have technical specifications for something, you can apply the specifications "for the thing closest to it to the maximum extent feasible."¹⁶

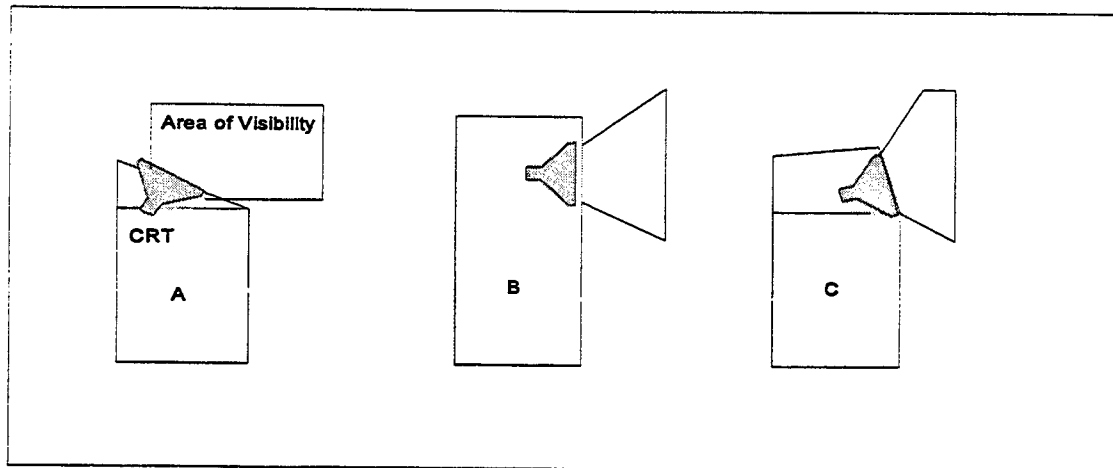
The cabinetry design of the kiosk is an important feature to meeting the requirements of ADA. Most kiosk vendors have built ADA compliance into their hardware. However, the agency must consider compliance versus functionality. The Federal Register, Volume 56, Number 173, includes ADA rules and regulations for making devices such as ATMs, telephones, and kiosks accessible to persons with disabilities.

Examples of three cabinetry designs are shown in Figure 3. Each kiosk has touch screen monitors positioned to meet ADA guidelines. Although kiosk A provides a lower viewing area, it may cause difficulties for individuals in wheelchairs. Reaching the touch screen may also be difficult. The viewing area in kiosk B may be high for short or seated users and the angle may be uncomfortable for taller users. Kiosk C provides viewing for tall, short, and seated viewers. The touch screen is accessible for all users, including persons in wheelchairs.

¹⁵Ibid, 835.

¹⁶TD Access & Safety Report, *Access Board Sets Standards for Accessible Kiosks*, October 9, 1996, 5.

Figure 3
Kiosk Cabinetry Designs



While certain techniques and devices are available to make kiosks user-friendly for travelers without disabilities, they may not provide the same benefits to a disabled person. For example, touch screen technology is good, but for blind people it is useless. Providing braille instructions can be helpful, however, the visually impaired user needs to receive the information through audio versus video means.

For users with sight impairments, a prototype talking kiosk has been developed by the Trace Research and Development Center in Madison, Wisconsin. The system uses a PC with a touch screen and an accent speech synthesizer. It is called the "Talking Fingertip" technique and uses four types of auditory information combined with kinesthetic response. An individual with a sight impairment can slide a finger across the touch screen and hear each item as it is traversed. A selection on the screen can be made lifting the finger from the screen. A selection is also available on the screen to cancel the kiosk function. Each screen has a unique selection, but the layout for all the screens contains a few standard selections. In addition, braille instructions can be posted near the kiosk for introductory information, since the nature of the kiosk is that each screen has a different layout.

The talking fingertip technology offers some advantages for disabled travelers. The layout and appearance for the talking fingertip kiosk are accessible for users with and without disabilities. As a result, the kiosk is easier to implement and to maintain than kiosks that

require special layout, special screens, and a different human interface for travelers with sight impairments. Additionally, it eliminates situations where users with vision impairments have access to less information through the kiosk than sighted users. Another benefit of this technology is that it facilitates use by individuals with cognitive impairments, and language and reading problems. The talking fingertip technique also has a speedlist mode to facilitate access by individuals with poorer spatial abilities and to speed up access on unfamiliar or complex screens.¹⁷

Although the technology is still considered experimental, the literature revealed that a company called Intuitive Solutions in Minnesota is developing a talking kiosk using the talking fingertip design.

3.7 Other Considerations

Transit systems will have other issues to decide beyond the type of kiosk system to build, the information that will be offered through the kiosk, and the cost. The literature suggests that the location of the kiosks, information on the kiosks and coordination with participants, marketing the devices to users, developing potential public/private partnerships, and changing technology are issues that may support or be obstacles to a successful kiosk system. Some of these issues, and strategies to resolve them, were revealed through the survey of transit agencies using kiosks. Information from the surveys and the literature on these issues are presented below.

3.7.1 Site location

Location, location, location, is a business adage, that indicates that the success of any business venture is dependent on the location. The information compiled through the survey of kiosk projects and the literature suggests that the adage might be applicable to planning a kiosk system as well. When determining the location of a kiosk, the potential site should provide benefits to visitors and daily commuters, and mitigate policy, institutional, and installation impacts. For example, during the development of the kiosk system at MARTA, one mall management company was approached as a potential participant in the project. The shopping malls managed by the company were considered

¹⁷Trace R&D Center, Madison, Wisconsin, *Talking Fingertip: Access to Touchscreen Kiosks and ATMs for Blindness and Low Vision*.

prime kiosk locations. While the locations provided benefits to potential users, the company considered the kiosk as a display of public information. They believed that if they allowed kiosks they could be forced to allow other forms of "free speech."¹⁸

MDTA has already developed a site selection process. Seven criteria are being considered in selecting recommended sites. These criteria are presented below.

- Community sensitivity
- Ease of Maintenance
- Numerous boardings and transfers
- Passengers needing assistance
- Single, unified bus stops or next to several stops
- Space for other amenities
- Three bus/rail routes serving the site
- Tourist usage

3.7.2 Information and Participants

Information provided through kiosks on transit routes and schedules may not require a significant amount of effort to develop and maintain. However, as transit information provided through a kiosk increases, so will the effort to maintain the system. For example, to provide real-time information, links between several databases within the transit agency may be needed. Besides providing transit information, kiosks are often used to inform travelers of weather conditions, other transportation news, and restaurant and recreational information. This will require greater coordination with public agencies and private participants and may evolve into an institutional issue.

Kiosks have an appeal beyond just transit information. Since information can be provided cheaply and efficiently through a kiosk, information from other agencies may be added to a transit kiosk system. Some transit kiosk projects already include airport information and access to the Internet. Allowing users to make financial transactions is a potential feature of kiosk projects that are being planned. For example, a kiosk can provide the same

¹⁸Elizabeth Williams, James Pohlman, et al, *Public/Private Partnering for the Georgia DOT Advanced Traveler Information Kiosks*, proceedings from the 1996 Annual ITS Meeting in Houston, TX, April 1996, 928.

services as an ATM, giving users access to their bank accounts. Another potential feature of a kiosk is that it can be used to update a fare card, sell tickets and dispense tokens. Transfers of bank account funds directly to fare cards at kiosks may also be welcomed by users.

Depending on how much information and the number of functions that are available through a kiosk, coordinating the efforts of the participants involved is an aspect of the project that should be given serious consideration. The survey of transit agencies revealed that for a kiosk project to be successful, all participants should be included in the development process as early as possible.

3.7.3 Marketing

Consideration should be given to developing a marketing plan that provides public information about the kiosk system and may stimulate interest from travelers. The Travlink project included a marketing program and disseminated information through television, newspapers, magazines, trade publications, radio, small group presentations, and trade shows. However, whatever the potential benefits of a kiosk, the net results are contingent upon use. Signs and cabinet design can help to stimulate user interest, but may be considered inappropriate in many environments, such as upscale hotels and shopping malls. As an alternative, the screen on the kiosk may serve as the best inducement by displaying a small amount of bright moving, colored lights or objects.

3.7.4 Public/Private Partnership

Developing partnerships with other public and private entities should be considered, when possible, as a strategy to reduce the cost and labor of a kiosk project. A cooperative arrangement is encouraged by the FTA. Public/private partnership arrangements were developed for the Travelink project in Georgia and the Travlink project in Minnesota; kiosks were a component of both projects. Similar to these projects, a public/private partnership may provide an opportunity for direct financial contributions through advertising, in-kind technology commitments, and kiosk purchases for additional deployment.

Companies can make direct contributions or donations in exchange for having their products or services advertised either on the kiosk cabinetry or screen. The company's name would also be associated with this advanced travelers' information system. Vendor

in-kind technology commitments or service would reduce the capital outlay and labor required for implementing the kiosk system. This provides an opportunity for the vendor to test their technology in a new market. It also gives an advantage to the vendor if a competitive bid process is used for a permanent kiosk system. Through a public/private partnership, additional kiosks can be deployed. For example, companies, shopping malls, etc. would pay the capital, operations, and maintenance cost to serve as a host site. Another example of the benefits from this arrangement was mentioned in the section on information and participants. The concept of using the kiosk as an ATM creates a beneficial partnership for the user, the financial institution, and the kiosk system operator. Lastly, this arrangement allows the public sector to explore these technologies while leveraging public funds.

Some literature suggests that many obstacles to a successful public/private partnership are the result of legal issues. The two largest problems identified by the participants in the Minnesota Travlink project were the length of time the project took and the legal issues that contributed to the delay. Some issues included proprietary issues and rights; copyright and ownership; license agreements; confidentiality; and ability to carry out partnership agreements under state laws.¹⁹ Another issue involves advertising on kiosks. Public places, which may serve as potential sites for kiosks, may already have advertising agreements (e.g., transit stations, airports, sports arenas, etc.). A new partnership may cause a breach of an existing advertising contract. Also, some public-rights-of-way prohibit advertising. The visual appeal of the kiosk will be an important factor if site locations are high-end hotels and office buildings. For these participants, the kiosk will need to fit their image.

3.7.5 Changing Technology

Computer technology is a rapidly changing industry. Therefore, consideration should be given to future changes in telecommunications and computer technology. For example, the efficiency and low cost of hard disk drives may provide enough space for data to be

¹⁹Cambridge Systematics, Inc., *Travlink Operational Test Institutional Analysis*, 4-1.

stored in kiosk units to increase system performance. Communication speeds and compression techniques have also been developed to the point that frequent updates to local data from a central source will be cost effective.²⁰

When selecting the system infrastructure, response time is critical because the length of time kiosk users have to wait for information will affect their use of the system. The literature suggests that system performance may be improved by using multiple specialized formats or separate indexes for every search criterion in the kiosk. Besides these techniques, a survey of the technology revealed a possible migration from a kiosk-based processing of information and content to Internet processing and server, using the kiosk as only a terminal. This technique would provide significant cost savings and enhance system performance. Additionally, vendors are developing kiosk systems that display information content in Hypertext Markup Language (HTML) format, allowing the same pages displayed on your Internet website to be used in the kiosk. Using the same software programming for a website and kiosk, the labor and cost of maintaining both systems can be reduced. It also will give the user more access to information.

The cabinetry design should also accommodate changes in computer equipment and other components, since some equipment may become unavailable or obsolete through the life of the enclosure.

Lastly, consideration should be given to the vendor's ability to meet the specifications of the contract. When asked about the "lessons learned" during the kiosk project, NJ Transit responded: "Use a vendor with quantifiable experience in transit and knowledge of telecommunications." NJ Transit ended its original kiosk project because the selected vendor, which agreed to supply the equipment at no charge, defaulted on the project.

²⁰J.L. Schroeder and Jeff Green, *The Emergence of Smart Traveler Kiosks and The User Interface Requirements for Their Successful Deployment*, Proceedings from 1995 ITS Annual Meeting, 835.

4. Conclusions

Except for the kiosk system at MARTA, most of the kiosks systems presented in this reserach were developed as operational tests. Generally, kiosks are used to display transit information for travelers. This includes bus arrival and departure information, routes, and schedules. Additional information is often provided on traffic and tourist attractions. None of the transit systems that have deployed kiosk allow users to make transactions such as purchasing tickets and passes.

For most of the kiosk systems, an AVL system was used to provide the kiosk with real time information. Data for most of the kiosks in this research was maintained at the site-location on CD-ROM or the hard-drive and by telecommunication links with a server. Generally, the kiosk units include either a 486 or Pentium CPU, touchscreen monitor, and either a laser or thermal printer. The cost for kiosk units range from \$15K to \$20k per unit. The cost range for kiosk units reflect various factors. The lower end of the range may indicate an interior or semi-exposed kiosk; a kiosk in an exterior location will cost more because of the additional protection necessary from adverse weather conditions. Other costs associated with deploying kiosks include software design, telecommunications connections, and cabinetry design.

Generally, most of the issues or obstacles in the kiosks projects in this study were caused by a breach in communication and coordination among participants in the project. For kiosk projects that provide only transit information, communication gaps between agency departments can jeopardize the success of the project. This issue becomes even more severe if the project involves coordination with outside agencies or private partners. In addition to having effective communication and coordination among participants, developing a criteria for site selection for kiosk units and making the system user-friendly were some of the "lessons learned" by transit agencies that have deployed kiosks.

After the operational tests were completed, an evaluation of the technology was conducted for future funding and expansion. Few of the agencies in this research have plans to continue their kiosk system beyond the demonstration phase. While the results of the operational test of kiosks were favorable for most agencies, funding and plans to expand these systems are not in place yet. For these agencies, any future development of kiosks will depend on available funding, agency support for the system, and competiton from

other projects. However, the ability of kiosks to disseminate transit and other information cost effectively to travelers is becoming more appealing to transit systems. Because of successful testing during the Olympics, MARTA is planning to expand their kiosk operation. The MTA in Baltimore has plans to expand their kiosk network around the City, and CALTRANS is planning to test a new prototype in the next two years.

5. Recommendations

The review of the state-of-the-art in kiosk technology and the survey of kiosk deployment at transit systems suggests MDTA should consider the following specifications.

1. Type of transit information available at Kiosks

Information presented in this research revealed the type of information that is normally provided through kiosks include:

- Real-time arrival and departure information on transit vehicles (i.e., buses and trains) and real-time schedules.
- Information on fares, routes, and special promotions.
- Information on regional transit services, such as paratransit and car and van pools.

The kiosk system should feature the ability to generate a trip itinerary for users. Beyond transit information, the kiosk should include information on traffic conditions, the weather, recreation, tourist attractions, and other major destinations. Before deciding on the information to provide through kiosks, it is recommended that MDTA survey current riders, non-users, and visitors to understand what features are most attractive in a kiosk system. MDTA may include information on public hearings concerning transit service changes or other transit issues. MDTA should also seek input from its own Divisions to determine if any other information should be included in the kiosk program.

2. Type of transactions at the kiosks and opportunities for sharing cost and services

Most transit kiosk systems do not include the ability to make any transactions such as purchasing tickets. Since this can cause significant security concerns, most agencies have decided to limit the services through the kiosk to providing only information. Until technology becomes available that will enable users to make financial transactions, it is recommended that MDTA omit this as a feature available at kiosks. However, opportunities do exist to share the cost and services of a kiosk system. Before beginning the operational test, MDTA should investigate the possibility of soliciting kiosk vendors that are willing to provide in-kind technology to reduce the capital outlay and labor required for

the kiosk system. For example, a kiosk vendor may be willing to provide kiosk units for the demonstration at no cost to MDTA. Similarly, the opportunities for sharing cost and services should be discussed with other Metro-Dade County agencies that may be interested in providing information through a transit kiosk. This report also recommends that as part of the site selection criteria, MDTA should consider locations that are willing to share the cost for installation, maintenance, liability, and security of kiosks. Additionally, MDTA should consider the opportunities for the kiosk to be revenue generators by allowing advertising on the screen or around the kiosk.

3. Security at Kiosk

A variety of strategies have been used for security at kiosks and for protecting the units from vandalism during the operational tests. These included using transit police, contracting with local police or a security firm, and putting kiosks in highly visible places with access limited to normal office hours. Using transit police or contracted security for routine surveillance at kiosks can be expensive, while placing the units in high traffic locations and limiting the hours of access is probably the least expensive alternative. The decision on which type of strategy to use will depend on the resources (i.e., project budget for security) that can be allocated for security. As a caveat, none of the agencies in this research reported any crimes or acts of vandalism associated with the kiosks. Aside from the touchscreen, the remaining functional parts (the computer, printer, and modem) are secured within the cabinetry.

Since this research has already recommended that MDTA provide only information at the kiosk, a minimum security strategy is recommended. This may be achieved by placing the kiosks in highly visible sites, such as in a mall or transit center with access limited to normal business hours. The cabinetry should be secured, and the entire structure should be secured to the ground. A special locking mechanism, specifically for kiosk, should be proposed by the vendor or MDTA. In addition, security may be enhanced by placing kiosks at locations where there are security guards or supervisors, such as train stations or transfer centers.

Besides protecting kiosks from vandalism and deterring crime at kiosk sites, the kiosk system will need to be secured from computer crimes. This includes computer viruses and "hackers." MDTA should consider protecting the integrity of the system by limiting public access through only kiosk units and other authorized links (i.e., Internet accounts).

This report recommends that MDTA develop software in-house to remote access from the public and the agencies linked to the system. If the software for the kiosk system is developed by the vendor, it should include some coding to prevent any unauthorized access.

4. Kiosk Equipment

The system architecture design should include a server to provide connectivity to the kiosks and other databases (i.e., FDOT, Weather Channel, AVL, CIS, TOS) and a PC-based operator workstation to serve as the primary operator interface to the system. Besides allowing updates to the kiosks, the workstation should allow MDTA to track usage, conditions, and maintenance.

The link between the kiosk server and other databases is critical to system performance. Thus, each kiosk unit should have a local database that is always connected to the server, so that real time data is constantly available to the kiosks. To enhance system performance, the connection between the server and other databases should use a T1 line. This may also permit future expansions to the system without any significant changes to the system architecture. However, the cost of using a T1 line versus regular telecommunication connections will need to be evaluated for cost efficiency and service performance. It is also important to consider that real-time data (defined as information transmitted in less than three minutes) needs to be distributed to the kiosk.

Computer Specifications: The kiosk should contain an energy star-rated computer capable of supporting the minimum requirements for communications, data storage, input/output (I/O) rates and expendability. The computer should be, at a minimum, a 166 MHz Pentium processor with 4 gigabyte hard drive and 32 meg of RAM. A modem that operates at a minimum of 28.8 bauds per second (Bps) or ISDN should be considered for linking kiosks to the workstation. Operating speed will depend on how much data is maintained at the kiosk site. The software should be written in a format to insure complete transferability of data to and from other databases. If possible, the software programming should enable the kiosk information to be displayed in HTML format. This will allow the same pages displayed on the kiosk to be used in an Internet website.

Touchscreen Monitor Specifications: A touchscreen, video display monitor, between 17" and 20" should be used and rated for outdoor use. The size of the monitor will depend on the site location.

Printer Specifications: A thermal printer should be used since its paper delivery system is proven in kiosks and poses fewer problems with paper jams.

Cabinetry Design: The cabinetry should be designed so that a laser printer can be placed in the kiosk to provide maps or directions for the user. The printer should be environmentally protected, so that the printer paper does not become damaged by the rain, cold, or heat. It should appeal to a diverse audience of users (i.e., transit dependent, commuter, tourist, etc.) and potential host sites. The cabinetry should comply with ADA standards and include braille instructions, voice enunciation, and speakers. The cabinetry design should consider future changes in kiosk hardware and be adaptable to those changes. For example, innovations in computer technology will undoubtedly influence the type of equipment used in a kiosk. As progress is made in kiosk technology, other information and transactions will become available at a kiosk, such as ticketing; it is also possible for a kiosk to serve as an ATM. Anticipating these changes in kiosk technology and including this feature in the design process will extend the life of the enclosure.

In addition, other hardware components should include continuous power supply, telephone handset (see 6 below), monitoring equipment, and speakers. These additions will depend on the location of the kiosk units. An office environment with a temperature range between 32F and 67F with humidity in the 10% to 50% range is recommended. Thus, any kiosks that are exposed to the climate in south Florida should include an air-conditioning unit.

5. Required Maintenance

Required maintenance for kiosks includes updating information periodically, system hardware repairs, and changes in technology. This report recommends that MDTA consider designating an in-house staff person to serve as a System Administrator. This

position should include the following responsibilities: serving as liaison with the public on issues involving kiosk operation; acting as point of contact for host sites; investigating and helping in resolving any problems with kiosk technology; coordinating meetings and communications with vendors and agencies that use the kiosk to distribute information; and upgrading and testing new software, hardware, and information for the kiosks. The qualifications for this position should include experience with MIS and transportation and familiarity with ITS.

6. Other User-Friendliness Features

Besides using a touch screen interface for travelers to find information in the kiosks, the cabinetry design of the kiosk should include some user-friendliness features. For example, the cabinetry design should be pleasant to the discriminating eye. The kiosk screen should use colors that limit eye strain but insure visual attractiveness to the passerby. Where possible, the screen should reduce the glare caused by the sun or external lighting. The dimensions of the screen should provide viewing for tall, short, and seated viewers (see example "C" on page 28). Kiosk information should be available in English and Spanish.

MDTA should consider the possibility of allowing travelers to access the Internet through the kiosks. While this may create more security problems for MDTA, it is a feature that may enhance the user-friendliness of the system. For example, the passerby may decide to use the kiosk to read or send e-mail and discover its usefulness to find information on transportation in the region. However, MDTA will need to limit kiosk users' access to the Internet. A session involving an Internet search or to send e-mail may cause unnecessary delays for travelers waiting to use a kiosk. Also, It creates an opportunity for "hackers" to access the system.

From a marketing perspective, a well designed interface screen can be an additional user-friendly feature. When a user ends their session and no queue is formed, an "inter-session" routine should take over. This subsystem can draw large colorful objects that constantly move across the screen or change the screen completely from one image to another. In addition, the screen can display a variable message sign to attract the attention of the passerby to abnormal conditions in the region. An example of an abnormal condition may include "Accident on I95 SB at Exit 4 (Flagler Street). From a security perspective, the kiosk units should include a telephone handset with a direct link to 911 or "panic button."

APPENDIX A - Information Kiosk System Survey

1. At what stage is your information kiosk system?

- ☐ Planning/definition
- ☐ Development
- ☐ Installation/Testing
- ☐ Full Operation/Implementation
- ☐ Expansion
- ☐ Other *Please specify:* _____

If your information kiosk system is being planned/defined or under development, when is it expected to be installed? In the next (check only one):

- ☐ 6 months ☐ 1 year ☐ 2 years ☐ beyond 2 years

2. What transit information is currently provided through your information kiosk? (check all that apply)

- ☐ Real-time arrival/departure information
- ☐ Real-time schedules
- ☐ Static arrival/departure information
- ☐ Static schedules
- ☐ Routes
- ☐ Fares
- ☐ Next-stop announcements
- ☐ Information on paratransit services
- ☐ Information on car/vanpool services
- ☐ Information on regional transit services, including commuter or light rail
- ☐ Other transit information *Please specify:* _____

3. What other information is currently provided through your information kiosk? (check all that apply)

- ☐ Traffic congestion
- ☐ Restaurant/Entertainment
- ☐ Tourism/Attraction
- ☐ Recreation
- ☐ Weather
- ☐ Other *Please specify:* _____

4. What type of transaction can be made at your information kiosk? (check all that apply)
- ☐ Card and ticket vending
 - ☐ Trip planning/ itinerary
 - ☐ Banking
 - ☐ Other *Please specify:* _____
5. What median of exchange is accepted at your information kiosk? (check all that apply)
- ☐ Coins/currency
 - ☐ Credit card
 - ☐ Debit card
 - ☐ Other *Please specify:* _____
6. Does your kiosk provide information in any of the following languages? (check all that apply)
- ☐ None
 - ☐ English
 - ☐ Spanish
 - ☐ French
 - ☐ Chinese
 - ☐ Japanese
 - ☐ Other *Please specify:* _____
7. What hardware specifications are used for your information kiosk? (e.g., type of computer, speed, memory, type of monitor, and printer)
- _____
- _____
- _____
- _____
- _____

8. What type of customer interface is used for your information kiosk? (check all that apply)
- ☐ Touch screen
 - ☐ Track ball
 - ☐ Basic buttons
 - ☐ Printer
 - ☐ Speakers
 - ☐ Other *Please specify:* _____
9. Is your information kiosk system integrated with any of the following technologies? (check all that apply)
- ☐ Automatic Vehicle Location (AVL)
 - ☐ Transit Operating System (TOS)
 - ☐ Customer Information Systems (CIS)
 - ☐ Other *Please specify:* _____
10. If your information kiosk provides real-time data, using Automatic Vehicle Location (AVL), what technology is used?
- ☐ Signpost
 - ☐ GPS
 - ☐ LORAN-C
 - ☐ Dead reckoning
 - ☐ Other *Please specify:* _____
11. How is data maintained for your information kiosk system? (check all that apply)
- | | | |
|---|---|--------------------------------------|
| <input type="checkbox"/> At-site location using: | <input type="checkbox"/> From a central location using: | <input type="checkbox"/> Both using: |
| <input type="checkbox"/> CD-ROM | | |
| <input type="checkbox"/> modem, what speed: _____ | | |
| <input type="checkbox"/> co-axial cable | | |
| <input type="checkbox"/> fiber-optic cables | | |
| <input type="checkbox"/> Other <i>Please specify:</i> _____ | | |

12. How is your information kiosk system maintained and monitored for hardware and software failure?

13. What efforts are used to maintain service quality against inclement weather ?

14. What type of security is used at your information kiosk against crime and vandalism?

15. What techniques are used to comply with the Americans with Disabilities Act (ADA)? (check all that apply)

- ☐ Videotext over television
- ☐ Audiotex
- ☐ Cabinetry design for ADA accessibility
- ☐ Braille
- ☐ Other *Please specify:*_____

16. What vendor(s) build and installed your information kiosk system?

17. What is the approximate cost for your kiosk system?

18. Who are the companies partnering (i.e., supplying kiosks free or at a discount) or sponsoring (i.e., paying for advertising space) your information kiosk system?

19. Do you have any surveys on kiosk users?

☐ Yes

☐ No

If yes, can we get the survey results?

☐ Yes

☐ No

Are there any technical and /or institutional issues or obstacles that surfaced during the development, installation, and operation of your information kiosk systems?

20. Are there any "lessons learned" that would benefit other organizations developing and implementing information kiosk systems?

21. Will other information be available through your information kiosk system in the future?

Thank you
Return by fax to :
Eric Hill
(813) 974-5168

APPENDIX B - List of Kiosk Vendors

AT & T
Ronald Van Oden
Suite 150
2343 Alexandria Drive
Lexington, KY 40504
606.885.8454

Transportation Management Solutions
Frances Sliwinski
800 International Drive
Linthicum, MD 21090
410.850.7890 ext. 4122

Etak, Inc., Gregg Roach
1430 O'Brien Drive
Menlo Park, CA
310.626.8200 ext. 110

Teleride Sage, Ltd.
Dean Thompson
156 Front Street West
Suite 500
Toronto, Ontario
Canada M5J 2L6
416.596.1940

Rockwell International (Non-Interactive
Kiosk)
Dave Ernst
400 Collins Road, N.E.
Cedar Rapids, IA
319.295.9138

JHK & Associates
James Pohlman
3500 Parkway Lane NW
Suite 600
Norcross, GA 30334
770.447.6831

Battelle
Jerry Pittenger
505 King Avenue
Columbus, OH 43201-2693
614.424.5189
*Jim Robertson, Project Manager for
Capital Region Traveler Information
Showcase - 804.786.6677*

Coleman Research Corporation
Phil Holdean
5950 Lake Hurst Drive
Orlando, FL 32819
407.352.3700

Kiosk Information Systems
2745 Industrial Lane
Unit 101
Broomfield, CO 80020
303.466.5471

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